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CircuitTree

CircuitTree Motor Controller

[Model #CT-ND-MC-480W]

User Guide

Revision: 2019.05.13

PRODUCT REGISTRATION & SUPPORT:

Please register your product online:
http://www.CircuitTree.net/register

→ Registering your product will greatly assist us to provide technical support if you need it.

Technical Support:
Please visit **www.circuittree.net** and click on the **Support** link in our main menu.

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www.CircuitTree.net • +1 844-477-7645
216 Puyallup Ave. #420 Tacoma, WA 98421

QuickStart Guide - CircuitTree Motor Controller

Model # CT-ND-MC-480W (rev. 3D)

This guide describes how to use the Motor Controller in "stand-alone" mode – the internal timer controls 2 light deprivation shades, the thermostat controls 2 sidewall vents. This unit is also "**smart-ready**" – it can be controlled wirelessly by the CircuitTree smart system, accessible through any smartphone, tablet, or computer.

Installation:

→ **Make sure the Motor Controller is not powered during installation.**
→ The long bundled cable on the bottom is the temperature sensor – place in a convenient location, ideally not in direct sunlight.

1) Mount the unit on a flat vertical surface using the included mounting hardware (taped to side.)
2) Thread your 4 motor wires through the 4 cable glands on the bottom of the Motor Controller. (Twist cable gland to open it, then twist it to close after cable is through. Close it snug.)
3) The **light deprivation** shade motors get wired to the 2 relays on the **left** side. For each motor, connect the motor's wires to a white wire and a blue wire (the one with a fuse). It doesn't matter which blue and white wire pair is chosen for each motor, as they are the same.
4) The **sidewall** vent motors get wired to the 2 relays on the **right** side.
(If you are only using light deprivation and not sidewall vents, it is fine to only wire up the 2 light dep motors, using only the timer & light dep feature. Disable the thermostat in this case.)

** If motors don't roll in the direction you're expecting, flip the wires to reverse the direction.*

5) Plug in the unit and set the Timer for light dep shades and Thermostat for sidewalls. (Details below.)

How It Works: The Motor Controller unit contains a "stop timer" which is independent of the timing threshold set directly on the motors. This defines the amount of time that each set of motors will receive power. When you press the manual UP/DOWN buttons or a command is sent from the timer or thermostat to move motors up or down, the controller provides power supply to the motors for this specified period of time. The motor knows to stop moving once it reaches the threshold set on the motor itself, even if it is still being provided power from the controller. The default stop timer values in the Motor Controller are 20 minutes for light deprivation shades and 10 minutes for sidewall vents, which should cover most standard greenhouse configurations and would not need to be adjusted. This amount of time is adjustable if you know your motors need more or less time.

IMPORTANT: You must set the maximum thresholds on the motors themselves, to limit how far the motors can move. These are adjustable by knobs on the motor, indicating the maximum number of rotations it will run before stopping. If you have not already set these thresholds, you must do so prior to automating the shades with this Motor Controller. Consult your greenhouse/motor documentation or support for more details. Essentially you need to watch the shade the first time it rolls up, observe when it has reached the point where you want it to stop, then manually stop the rolling – then set that as the motor threshold.
** *Failure to set the motor thresholds can result in damage to your greenhouse shades from over-rolling!* **

- Only 1 pair of motors can be used at a time – light dep or sidewall. (Not simultaneously.)
- The sidewall vent motors cannot be operated while light deprivation shades are closed.
- If a request is sent to close light dep shades, the sidewall vents will be closed first (if they're open) before light dep shades close. If a request is made to open sidewalls while light dep shades are closed, sidewalls will be locked out and request will be ignored.

Basic Usage:

- When the unit is plugged in, all of the LEDs next to the buttons flash 1 time, then will resume indicating their current state. (Controller will remember and indicate if motors are up or down, if AUTO is on, etc.)
- Set the programming for the Timer and the Thermostat before turning on AUTO mode.
- Automation is not running until you activate it by pressing the "AUTO" button for the light dep or sidewall channels. The LED lights next to the AUTO button will be lit if automation is active. In AUTO mode the internal timer and thermostat are controlling the light dep and sidewall motors.
- If AUTO is not active, the controller is in Manual mode. The UP ⇧ and DOWN ⇩ buttons move the light dep or sidewall motors. If you manually move the light dep or sidewall motors, AUTO will turn off since the motors have been moved separately from the automation settings. (Be sure to put the unit back into AUTO mode if you want to resume the automation after a manual movement.)
- You can flip the circuit-breaker as a full stop switch if needed – this cuts power to the motors and everything except the power supply.

Automation:

The internal timer and thermostat work as toggle devices for stand-alone automation. The timer automates the light dep motors, the thermostat automates the sidewall motors. Each device toggles a relay ON or OFF. When the relay turns ON, the motors automated by that device move UP to the open position. When the relay turns OFF, the motors automated by that device move DOWN to the closed position.

Buttons → Manual Control & Programming:

The 3 buttons on the outside of the unit can be used for manually moving the light dep shades or sidewall vents up/down, and for programming internal timing parameters of the Motor Controller.

Buttons respond to a normal **short press**, or have a different function if you hold the button down (**long press**).

There are LEDs on each side of the buttons – the left side (green) is for the light dep shades, the right side (red) is for the sidewall vents. The left channel (light dep) is considered "master" because the status of the light dep shades being up or down determines whether the sidewall vents are in lockdown or allowed to be opened.

The unit starts up with the buttons in manual operation with the left channel selected. In manual mode, when all motors are stopped, all LEDs are off. In automation mode, the LED is illuminated next to the "AUTO" button. AUTO mode means that the motors are controlled by the timer and thermostat.

Pressing the UP (⇧) button will activate motors to move up. Pressing the DOWN (⇩) button activates motors to move down. The light blinks while motors are moving or waiting to move, and remains lit (solid) when complete. To stop a motor from moving in a direction, press that same direction button again.

Long-pressing any button will switch the manual motor control between the left channel (green/light dep) and the right channel (red/vent). All 3 of the LEDs on the activated side will light up before you release the button from long press, as a visual confirmation of which side is active.

> Example usage: Long-press the UP button to select which side you are controlling,
> then regular short-press the UP button again to activate that motor to go up.
> To stop motor from moving up while it is in progress, press the UP button again.

If you attempt to move the sidewalls while the light dep shades are closed or moving, the available LED lights will all flash once to indicate the sidewalls are in "lockout" mode and cannot be operated with light dep closed.

Configuration mode is used to set the stop-timers for each channel and change internal settings. See the complete user guide for info on using Configuration mode.

Timer → Light Deprivation Shades:

Flip open the front cover of the timer to access its buttons. "Manual" button toggles between AUTO, ON, and OFF. AUTO means automation is on, relays will activate at programmed times. OFF means the timer is disabled and not controlling light dep. ON means the relay is active and stays active until changed. (We recommend not using the "ON" or "OFF" setting – just use the button controls to manually move shades.)

To set the current time and date, hold the Clock button and use the Day (D+), Hour (H+) and Minute (M+) buttons to adjust.

Press the "P" button to program timer. The timer is capable of holding many different on/off times, but you only need to use one timer to open & close light dep shades. Each time you press "P" it will switch between the available timer slots – each one has an ON time and an OFF time, as shown on the display. Using the Day (D+) button will allow setting timer for specific days – for daily light dep purposes you'd want all days to be activated, with the whole week shown across the top of display. Pressing the clock button exits out of programming.

Thermostat → Sidewall Vents:

The thermostat in this unit operates in °C. See the chart inside the lid for easy conversion to °F.

← Detected temperature from sensor probe

← Set temperature. "C" = "Cooling" mode, "H" = "Heating". Use Cooling mode for sidewalls.

Sidewall motors open if the detected temperature exceeds the set temperature **+ range** (hysteresis).
Sidewall motors close when the detected temperature drops below the set temperature.
Press STOP to toggle thermostat between AUTO or OFF. "OUT" blinks when thermo automation is disabled.

The SET button toggles between different settings which can be adjusted using the UP or DOWN buttons. The selected setting will flash and you can then edit it. In Settings mode, the top value in the LCD display changes from the current temperature to the range (hysteresis). After 3 seconds of no button presses, settings are saved.

The "temperature range" is set so the sidewall vents aren't constantly triggering open and closed when the temperature is hovering right around the set temperature. The range provides a slight difference between the opening temp and the closing temp. The range is set to 2ºC by default – you can change this by pressing SET until the range is selected (press 3 times), then use UP or DOWN to set the range – wait a few seconds without pressing buttons to exit setup mode.

Long-pressing the SET button enters a different type of settings. "ALA" is an optional audio alarm for when a high temperature setting is reached. "OPH" is a timer delay of minutes that must pass after an open/close action before another action is taken by the thermostat. "OFE" is sensor probe calibratiot. (0.7 is the default calibration setting for the long sensor probe built-in to the unit.)

2. ADDITIONAL INFO

We recommend always using some form of surge protection with CircuitTree devices. You must use surge protection in order for your warranty to remain valid. At minimum, use a surge protector or surge protective power strip at the outlets where each device is used -- or a "Type 2" ("whole house") surge protective panel.

Many small electronics and "smart" devices are sensitive to power surges. Power surges can be introduced onto your electrical wiring by pumps, heating & air conditioning units, clothes washers & driers, and other large appliances or devices with large motors. These power surges can potentially cause malfunctions or reduce the lifespan of small electronic gear. Using a surge protector is an inexpensive but very important investment into keeping your CircuitTree automation gear safe.

Also keep in mind that momentary interruptions in power can cause your hardware to restart. To prevent this, you can use a "UPS" unit (Uninterrupted Power Supply) -- these provide a battery backup **and** surge protection. The battery backup will keep your equipment powered on even in a temporary power outage, and will enable your shades to still continue opening and closing for as long as the UPS unit has power available in its battery. We highly recommend using a large-sized high-capacity UPS unit to help insure smooth operations during temporary power outages or surges. (Small UPS units may not have enough capacity to fully complete rolling the shades in an extended power outage.)

Common Sense Usage:

You've made a smart choice to save time and energy by automating some aspects of your garden. However, this doesn't cancel the responsibility to still monitor your garden visibly as you normally would, to make sure everything is healthy and that all gear is operating as intended. Automation is not a full replacement for human participation and observation. 😉 Upgrading to the full CircuitTree smart system (with internet connection) provides some additional options to help insure everything is on-track, including the ability to detect light levels inside a greenhouse (using our Environment Sensor Node), ability to remotely control or view the up/down state of shades, ability to send notifications by text message or e-mail, and ability to remotely view video camera monitoring.

Handling Power Interruptions:

If power is interrupted while the shades are in the middle of opening or closing, they will resume operations based on the timer or thermostat programming once the power is returned. The Motor Controller will send power to the motors for the full amount of time set in the "stop timer". (By default, this is 20 minutes for light dep shades and 10 minutes for sidewalls, unless you have adjusted the stop timer.) This insures the motors will fully open or close when power is restored to the device, even if the power went out mid-way through a motor operation. The timing threshold set on the motors themselves will insure that shades are not over-rolled, regardless of the length of time the Motor Controller is providing power to the motors.

Thermostat settings are remembered even without power. (They are stored in a small bit of memory on the thermostat.) In the event of a power interruption, the thermostat will resume its normal programming once power is returned. Timer settings are remembered for up to 3 years without power.

Water Resistance:

The Motor Controller has a basic level of water resistance (splash protection) with the lid closed and the button cover also closed. Please leave the lid and button cover closed at all times to protect from water. The temperature probe is waterproof and can be placed anywhere.

3. ADVANCED PROGRAMMING

Configuration Mode is used to set the stop-timers for each channel and change internal settings. To enter configuration mode for the selected channel, AUTO must be disabled with motors not moving. Press all 3 buttons simultaneously then release. **All** LEDs will illuminate. Simultaneously press and release all 3 buttons at once again to exit Configuration Mode.

While in configuration mode for the selected channel, long-press and hold the middle button to set the stop-timer for that channel by increments of 5 minutes for each LED blink. Short-press the middle button to decrease the stop-timer by 1 minute per button press. The stop-timer can be set to 0 to effectively disable it (for example, useful to set the Sidewall stop timer to 0 on a greenhouse that is only using Light Deprivation and has no Sidewalls.)

> Example usage: To set the stop-timer of the Light Deps to 18 minutes, Long-press the UP button to select the Light Dep channel. Press all 3 buttons at once, then release. All LEDs will be lit to indicate Configuration Mode. Press and hold the middle button and count 4 LED flashes for a setting of 20 minutes (4 * 5 = 20). Then regular short-press the middle button twice to decrease the stop-timer by 1 minute for a setting of 18 minutes. To exit configuration mode, press all 3 buttons at once, then release.

4. EXPANSION: FULL WIRELESS SMART SYSTEM

This Motor Controller is also programmable wirelessly by the full CircuitTree smart system. Using our master Industrial Controller, you can securely access the operation and programming of this Motor Controller through any smartphone, tablet, or computer. A variety of other smart agricultural devices are available for smart control. The wireless communications use reliable RF (Radio Frequency) signals and does not *require* internet access. (Additional features are available with internet access, such as the ability for the smart system to send notifications and alerts via e-mail and text message.)

Additional CircuitTree nodes include:

- **Power Nodes:** 2x10Amp & 1x30Amp
- **Fluid Valves**
- **Environmental Sensor Nodes:** Temperature, Humidity, Air Pressure, Light Sensor
- **Light Dimmer Nodes**
- **Automatic Light Lifters**
- **Soil Moisture Sensor Node** (coming soon)
- **CO2 Sensor** (coming soon)

Refer to the main CircuitTree User Guide for instructions on how to use the Industrial Controller and how to add Motor Controllers as a node.

Appendix A: TROUBLESHOOTING & SUPPORT

Technical Support:
Please visit **www.circuittree.net** and click on the **Support** link in our main menu.

Also from that Support area of our web site, refer to our **Forums** section. The forums are a continuously growing collection of helpful tips and answers to common usage questions -- and you can interact directly with our support and development team there. Community discussion is encouraged.

Common Troubleshooting Tips:

- **Motor Controller Unresponsive, Requires Hard (Manual) Reboot**

Power surges and fluctuations have been known to cause nodes to become unresponsive and require a manual reboot. Unresponsive nodes that are still powered (lights stuck either ON or OFF) are generally a sign of power issue, like surges or momentary power outage. Especially if you are in an area or setting where power outages or surges are common, the use of a high-capacity "UPS" unit (Uninterrupted Power Supply) is highly recommended. (See the recommendations on this topic earlier in this manual.)

If you have hard-wired the Motor Controller to electricity so it cannot be easily unplugged or powered off for a hard reboot, use the circuit breaker to cut power.

- **Pressed Button to lower Light Deprivation shade, but Sidewall/red LED is flashing instead**

This indicates that the Sidewall motor status was either open or undefined, so the Motor Controller must first send a command to insure the Sidewall vents are closed before it can close the Light Dep shades. The Light Deprivation shades will begin to close after enough time has passed to close the Sidewalls. (10 minutes by default unless you have adjusted the "stop timer" for the Sidewalls.) Remember – the Sidewalls are not allowed to be open when the Light Dep shades are closed, so any command sent to close the Light Dep must first make sure the Sidewalls are closed before the Light Dep shades can be moved.

The first time the Motor Controller is used, the Sidewall motors are in an "undefined" state, meaning the controller does not know yet whether Sidewalls are open or closed. The first time you send a command to lower Light Deprivation shades, the Sidewalls will close first so the controller knows *for sure* the status of the Sidewalls from that point onwards. This is normal expected behavior the first time the Motor Controller is used and the first time you lower the Light Dep shades – be prepared to wait the additional minutes for the Sidewall closing before you see the Light Dep shades begin moving.

Appendix B: TECHNICAL SPECIFICATIONS

Power:

- **Output:** 20 Amp DC output powers 2 motors at a time with 10 Amps per motor
- **Input:** 90 to 264VAC, 4.8A at 115VAC, 2.4A at 230VAC
- **Over Temperature Protection:** shuts down output voltage and recovers automatically after temperature goes down
- **Working Temperature:** -20 to +70°C (-4 to 158°F)
- **Working Humidity:** 20 to 95% Relative Humidity (non-condensing)
- **Fuse Type:** ATM 10A Blade Fuse (1 fuse per motor)
- **20A Circuit Breaker protection**

Thermostat:

- **Temperature Control Range: -50 to 100°C (-58 to 212°F)**
- **Temperature Control Precision: 0.1°C**
- **Refresh Rate: 0.5 seconds**
- **Configuration settings retained through power cycles**

Timer:

- **Time Accuracy:** +/- 1 second/day at 20°C
- **Ambient Temperature:** -20 to 50°C (-4 to 122°F)
- **Minimum Programmable Time:** 1 Minute
- **Maximum Programmable Time:** 168 Hours
- **Battery Backup for time and settings:** 3 years, rechargeable

MicroController RF Wireless:

- 433MHz, 868MHz, or 915MHz depending on geographical region
- Configuration settings retained through power cycles
- On-board watchdog timer and fail-safe protections

Weight: 8.5 lbs.

Appendix C: LIMITED WARRANTY

Remember to retain your Bill of Sale for warranty service! Any items returned without a copy of the Proof of Purchase will be considered out of warranty.

As with all software-controlled products, unexpected behavior could arise if the user tries to perform operations in a non-routine manner. This product, like almost any other high-tech product, is subject to revisions and upgrades over time. Product specifications are subject to change without notice.

What the Warranty Covers:

• This warranty extends only to the original user of the equipment and is limited to the purchase price of each part. CircuitTree, LLC and its affiliated companies ("CircuitTree") warrant this system against defects in materials or workmanship as follows:

• **Labor:** For a period of one (1) year from the original date of purchase, if CircuitTree determines that the equipment is defective subject to the limitations of this warranty, it will be replaced at no charge for labor. CircuitTree warrants any such work done against defects in materials or workmanship for the remaining portion of the original warranty period.

• **Parts:** For a period of one (1) year from the original date of purchase, CircuitTree will supply, at no charge, new or re-manufactured parts in exchange for parts determined to be defective subject to the limitations of this warranty. CircuitTree warrants any such replacement parts against defects in materials or workmanship for the remaining part of the original warranty period. Note: "Parts" means items included with the sale of the item in CircuitTree's original package, which may include the router, single board computer, RF gateway, antennas, or enclosure. It does not include other parts purchased separately.

What the Warranty Does Not Cover:

• This warranty does not cover installation of the system. If applicable, such installation will be warranted under a separate installation agreement.

• This warranty does not cover consumer instruction, physical setup or adjustment of any devices, or loss of use of the system.

• This warranty does not cover cosmetic damage, damage due to lightning, electrical or network line surges, battery leakage, fire, flood, or other acts of Nature, accident, misuse, abuse, repair or alteration by other than authorized factory service, use of accessories not recommended by CircuitTree, negligence, or improper or neglected maintenance. Please refer to the notice about surge protection requirements earlier in this document. If you do not use surge protection, this warranty is void.

• This warranty does not cover shipping and handling, removal or reinstallation, shipping damage if the equipment was not packed and shipped in the manner prescribed, nor equipment purchased, serviced, or operated outside the continental United States of America or Canada.

Legal Limitations

REPLACEMENT AS PROVIDED UNDER THIS WARRANTY IS YOUR EXCLUSIVE REMEDY. CIRCUITTREE SHALL NOT BE HELD LIABLE FOR ANY INCIDENTAL OR CONSEQUENTIAL DAMAGES FOR BREACH OF ANY EXPRESSED OR IMPLIED WARRANTY ON THIS SYSTEM, NOR FOR ANY INCIDENTAL OR CONSEQUENTIAL DAMAGES RESULTING FROM THE USE OF, OR INABILITY TO USE, THIS SYSTEM. UNDER NO CIRCUMSTANCES SHALL CIRCUITTREE'S LIABILITY, IF ANY, EXCEED THE PURCHASE PRICE PAID FOR THIS SYSTEM. EXCEPT TO THE EXTENT PROHIBITED BY APPLICABLE LAW, ANY IMPLIED WARRANTY OF MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE ON THIS SYSTEM IS LIMITED IN DURATION TO THE PERIOD OF THIS WARRANTY. CIRCUITTREE RESERVES THE RIGHT TO REFUSE TO HONOR THIS WARRANTY IF CIRCUITTREE DETERMINES ANY OF THE ABOVE EXCEPTIONS TO HAVE CAUSED THIS SYSTEM NOT TO HAVE PERFORMED PROPERLY. THIS WARRANTY SHALL BE VOID IF ANY FACTORY-APPLIED IDENTIFICATION MARK, INCLUDING BUT NOT LIMITED TO SERIAL OR CONDITIONAL ACCESS NUMBERS, HAS BEEN ALTERED OR REMOVED. THIS WARRANTY SHALL ALSO BE VOID IF THE HARDWARE HAS BEEN SERVICED BY AN UNAUTHORIZED PERSON.